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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/763,068	01/22/2004	Xiaogang Peng	40715-296579	3712
23370 7590 04/22/2008 JOHN S. PRATT, ESQ. KILPATRICK STOCKTON, LLP 1100 PEACHTREE STREET ATLANTA, GA 30309				
EXAMINER				
TSOY, ELENA				
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/763,068

Applicant(s)

PENG ET AL.

Examiner

Elena Tsoy

Art Unit

1792

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 March 2008.
2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-98 and 100-108 is/are pending in the application.
4a) Of the above claim(s) 1-57, 69-98 and 100-108 is/are withdrawn from consideration.
5) ☐ Claim(s) _____ is/are allowed.
6) ☒ Claim(s) 58-68 is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
10) ☒ The drawing(s) filed on 22 January 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on March 21, 2008 has been entered.

Response to Amendment

Amendment filed on March 21, 2008 has been entered. Claims 1-98, and 100-108 are pending in the application. Claims 1-57, 69-98, and 100-108 are withdrawn from consideration as directed to a non-elected invention.

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 58-68 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed invention. Claims 58 and 59 recite “*resulting in a mixture comprising the solution of core nanocrystals, the cation precursor solution and the anion precursor solution*”, which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the claimed

invention. The Applicants specification describes in P161 that shell may be formed employing either accurate amount of cation and anion precursors sufficient as to form one monolayer at a time or less than one monolayer by adding less than precursors, or in excess of precursors. Thus, it seems that in all three embodiments there are no (uncoated) core nanocrystals should be present with *both* cation and anion precursors.

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 58-68 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Language of claims 58 and 59 is confusing because it is not clear how after covering the core nanocrystals with a monolayer of cation, the core nanocrystals are still present by the time of adding anion precursor.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 58-68 are rejected under 35 U.S.C. 103(a) as being unpatentable over Reiss et al (*Nano Letters*, 2 (7), 781 -784, 2002) in view of Nicolau (US 4675207).

Reiss et al disclose a method for preparing CdSe/ZnSe (claimed formula M^1X^1/M^2X^2) core/shell nanocrystals having impressively high photoluminescence (PL) efficiency (See Abstract) comprising slowly injecting a mixture of a solution of ZnO complexed with dodecylphosphonic acid or zinc stearate in toluene as the zinc precursor and a solution of TOPSe (Se-trioctylphosphine) in TOP into a solution of CdSe core nanocrystals in HAD (hexadecylamine)/TOPO (trioctylphosphine oxide) (See page 781, second paragraph) (See page 782, second paragraph, page 783, reference (24)).

Reiss et al fail to teach that the shell is formed by applying a cation (M^2) precursor and an anion (X^2) precursor separately from each other in an alternating manner (Claim 58).

However, Nicolau teaches that deposition in solution with providing cationic and anionic constituents in an alternating manner permits deposition of monocrystalline or polycrystalline, fault-free, compact layers of compounds of formula C_mA_n (wherein C represents a cation, A represents an anion) having *homogeneous* thickness and desired *stoichiometry* of the deposited compounds in contrast to the presently known processes such as vapour phase deposition and deposition in solution with *simultaneous* addition of cationic and anionic constituents (See column 1, lines 23-52).

As to Amendment, Nicolau teaches that deposition in solution with providing cationic and anionic constituents in an alternating manner permits deposition of monocrystalline or polycrystalline, *fault-free, compact* layers of compounds of formula having *homogeneous* thickness and desired *stoichiometry* of the deposited compounds in contrast to deposition in solution with *simultaneous* addition of cationic and anionic constituents. Nicolau teaches that the growth of the thin film of the compound take place by heterogeneous chemical reaction at the substrate-solution interface between cations C and anions A adsorbed on the substrate so that on

immersing the substrate in the first solution, which e.g. contains an ionized salt of the cationic constituent C, there forms on the substrate a double electrical layer of the Helmholtz type comprising a cationic layer of the cationic constituent C and an anionic layer of the anion of the salt present in the first solution (See column 3, lines 6-15). The two superimposed ionic layers respectively containing the cationic constituent C and the anionic constituent A are formed by successive immersions of the substrate in a first solution containing cationic precursor and a second solution anionic precursor, said substrate undergoing rinsing by a solvent between two immersions (See column 3, lines 21-40). In other words, rinsing after immersing the substrate into cation precursor solution (that removes the cation precursor solution from the substrate) prevents cation and anion to coexist thereby preventing local nucleation on the substrate or in the solution so that desired fault-free, compact layers of *homogeneous* thickness and desired *stoichiometry* of the deposited compounds are obtained.

Obviously, M^1X^1/M^2X^2 core/shell nanocrystals may be deposited without rinsing between immersions so that some amount of unreacted cation precursor would be still present on the substrate after first immersion since Reiss et al teaches that M^1X^1/M^2X^2 core/shell nanocrystals can be prepared by *simultaneous* addition of cationic and anionic constituents to core nanocrystals, which results in a mixture comprising the solution of core nanocrystals, the cation precursor solution and the anion precursor solution. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to prepared M^1X^1/M^2X^2 core/shell nanocrystals of Reiss et al using a deposition in solution with providing cationic and anionic constituents in an alternating manner with the expectation of providing the desired monocrystalline or polycrystalline, fault-free, compact layers of *homogeneous* thickness and desired *stoichiometry* of the deposited compounds, as taught by Nicolau.

It would also be obvious to one of ordinary skill in the art to prepare M^1X^1/M^2X^2 core/shell nanocrystals of Reiss et al *with or without* rinsing between immersions depending on particular use of core/shell nanocrystals.

As to claims 61-62, Nicolau teaches that the arrangement of the cationic and anionic layers with respect to the substrate is dependent on the nature thereof and it is consequently possible to have either the cationic layer or the anionic layer in contact with the substrate (See column 3, lines 16-20).

As to claim 63, Reiss et al teach that structural defects in the shell low fluorescence quantum yield (See page 781, paragraph 1). Obviously, any impurities would act as structural defects in the shell. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have purified a core/shell nanocrystal in the cited prior art with the expectation of providing the desired maximum fluorescence quantum yield.

As to claim 65-68, Nicolau teaches that substrates may be monocrystalline metallic substrates, e.g. of Zn or Cd, monocrystalline semiconductor substrates, e.g. of Ge, GaAs or InP (See column 6, lines 3-10), and precursors for the formation of ionic layers are preferably salts such as **zinc suphate** (See column 9, line 64), complexes or compounds *dissolved in any* solvent, e.g. water, organic solvents or mixtures of the water and organic solvent, where the salts, compounds or complexes present in these solutions can be in the dissociated state (See column 6, lines 14-36). In the solutions, the cationic or anionic constituents can be present in the form of a **complex** with an appropriate ligand, e.g. **ammonia**, which is soluble in the solution (See column 6, lines 30-33).

7. Claims 58-68 are rejected under 35 U.S.C. 103(a) as being unpatentable over Reiss et al in view of Nicolau, further in view of state of art admitted by Li et al (JACS, 9/23/2003).

The cited prior art is applied here for the same reasons as above. Nicolau does not expressly teach that rinsing after immersing the substrate into a cation precursor solution (that removes the cation precursor solution from the substrate) prevents cation and anion to coexist in the solution thereby preventing reaction between cation and anion in the solution so that the reaction would occur only on the surface of the substrate. However, Li et al admitted in the Introduction that it is known in the core/shell nanocrystals art that switching molecular beams of cationic and anionic species on and off in a method of ALE prevents cationic and anionic species to coexist so that local nucleation on the substrate or in the gas phase is avoided. Consequently, the thin film grows in a well controlled manner. This *concept was extended* to the deposition of thin films onto solid substrates using *solution* bath, successive ionic-layer adsorption and reaction (SILAR). See page 12568, column 2, P2.

Therefore, rinsing in Nicolau after immersing the substrate into cation precursor solution that removes the cation precursor solution from the substrate and prevents cation and anion to coexist, prevents local nucleation on the substrate or in the solution, as evidenced by state of art admitted by Li et al, so that desired fault-free, compact layers of *homogeneous* thickness and desired *stoichiometry* of the deposited compounds are obtained.

8. Claims 58-68 are rejected under 35 U.S.C. 103(a) as being unpatentable over Reiss et al (*Nano Letters*, 2 (7), 781 -784, 2002) in view of Kondow et al (US 5300793) and Nicolau (US 4675207) for the reasons of record set forth in paragraph 3 of the Office Action mailed on 4/2/2007.

As to Amendment, See above.

Response to Arguments

9. Applicants' arguments filed March 21, 2008 have been fully considered but they are not persuasive.

(A) Applicants assert that high or ultrahigh vacuum conditions provide an ideal environment for epitaxial growth because contaminants and chemical species other than the intended reactants are not present to disrupt crystal lattice formation and crystal growth. Solution phase synthesis, however, provides the exact opposite conditions to those of a vacuum. In solution phase synthesis, a variety of species are present that could disrupt proper lattice formation and crystal growth. As a result, it is improper for the Office to equate high vacuum synthetic techniques, such as those described by Kondow, with the solution phase synthetic techniques of the present invention.

The Examiner respectfully disagrees with this argument. Nicolau compares his process to the presently known processes such as **vapour phase** deposition and deposition in **solution** with *simultaneous* addition of cationic and anionic constituents (See column 1, lines 23-52). See also Li et al (JACS, 2003) discussed above.

(B) Applicants assert that Nicolau fails to cure the deficiencies of Reiss because Nicolau discloses a method of immersing a unitary substrate in various individual salt solutions with rinsing between immersions. The rinsing step required by Nicolau is administered to clear the substrate of excess solution thereby facilitating the formation of at least two superimposed ionic layers.

The Examiner respectfully disagrees with this argument for the reasons discussed above in P6 and 7.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after

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the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Elena Tsoy whose telephone number is 571-272-1429. The examiner can normally be reached on Monday-Friday, 9:00AM - 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Timothy Meeks can be reached on 571-272-1423. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Elena Tsoy, Ph.D.
Primary Examiner
Art Unit 1792

April 22, 2008

Art Unit: 1792

/Elena Tsoy /

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